



## SEQUENCE LISTING

<110> Edwards, David L.  
Hernstadt, Corinna  
Wilcox, Edward R.  
Wong, Siu-Yin

<120> Process for Altering the Host Range of Bacillus thuringiensis Toxins, and  
Novel Toxins Produced Thereby

<130> M12C1FDF3D2

<140> US 10/035,060

<141> 2001-12-27

<150> US 09/405,788

<151> 1999-09-27

<150> US 08/855,160

<151> 1997-05-13

<150> US 08/580,781

<151> 1995-12-29

<150> US 08/420,615

<151> 1995-04-10

<150> US 08/097,808

<151> 1993-07-27

<150> US 07/980,128

<151> 1992-11-23

<150> US 07/803,920

<151> 1991-12-06

<150> US 07/356,599

<151> 1989-05-24

<150> US 06/904,572

<151> 1986-09-05

<150> US 06/808,129

<151> 1985-12-12

<160> 9

<170> PatentIn version 3.1

<210> 1

<211> 3531

<212> DNA

<213> Bacillus thuringiensis

RECEIVED

OCT 10 2002

TECH CENTER 1600/2900

<400> 1  
atggataaca atccgaacat caatgaatgc attccttata attgtttaag taaccctgaa 60  
gtagaagtat taggtggaga aagaatagaa actggttaca cccaatcga tatttccttg 120  
tcgctaacgc aattttctttt gagtgaattt gttcccgggtg ctggatttgt gttaggacta 180  
gttgatataa tatggggaat ttttgggtccc tctcaatggg acgcatttct tgtacaaatt 240  
gaacagttaa ttaaccaaag aatagaagaa ttcgctagga accaagccat ttctagatta 300  
gaaggactaa gcaatcttta tcaaatttac gcagaatctt ttagagagtg ggaagcagat 360  
cctactaatc cagcattaag agaagagatg cgtattcaat tcaatgacat gaacagtgcc 420  
cttacaaccg ctattcctct ttttgcagtt caaaattatc aagttcctct tttatcagta 480  
tatgttcaag ctgcaaattt acatttatca gttttgagag atgtttcagt gtttggacaa 540  
agggtggggat ttgatgccgc gactatcaat agtcgttata atgatttaac taggcttatt 600  
ggcaactata cagattatgc tgtacgctgg tacaatacgg gattagaacg tgtatgggga 660  
ccggattcta gagattgggt aagggtataat caatttagaa gagaattaac actaactgta 720  
ttagatatcg ttgctctgtt cccgaattat gatagtagaa gatatccaat tcgaacagtt 780  
tcccaattaa caagagaaat ttatacaaac ccagtattag aaaattttga tggtagtttt 840  
cgaggctcgg ctcagggcat agaaagaagt attaggagtc cacatttgat ggatatactt 900  
aacagtataa ccatctatac ggatgctcat aggggttatt attattggtc agggcatcaa 960  
ataatggctt ctctgtagg gttttcgggg ccagaattca cttttccgct atatggaact 1020  
atgggaaatg cagctccaca acaacgtatt gttgctcaac taggtcaggg cgtgtataga 1080  
acattatcgt ccactttata tagaagacct tttaatatag ggataaataa tcaacaacta 1140  
tctgttcttg acgggacaga atttgcttat ggaacctcct caaatttgcc atccgctgta 1200  
tacagaaaaa gcggaacggt agattcgctg gatgaaatac cgccacagaa taacaacgtg 1260  
ccacctaggc aaggatttag tcatcgatta agccatgttt caatgtttcg ttcaggcttt 1320  
agtaatagta gtgtaagtat aataagagct ccaacgtttt cttggcagca tcgcagtgc 1380  
gaatttaata atataattcc ttcatacaaa attacacaaa tacctttaac aaaatctact 1440  
aatcttggct ctggaacttc tgctgttaaa ggaccaggat ttacaggagg agatattctt 1500  
cgaagaactt cacctggcca gatttcaacc ttaagagtaa atattactgc accattatca 1560  
caaagatatc gggtaagaat tcgctacgct tctactacaa atttacaatt ccatacatca 1620  
attgacggaa gacctattaa tcagggtaat ttttcagcaa ctatgagtag tgggagtaat 1680

ttacagtc	ccg	gaagcttt	tag	gactgtag	gtt	tactactc	cgtttaactt	ttcaa	atgga	1740
tcaagtgt	at	ttacgtta	aag	tgctcatg	tc	ttcaattcag	gcaatgaag	ttatatag	at	1800
cgaattga	at	ttgttc	ccggc	agaagta	aacc	tttgaggcag	aatatgattt	agaaagag	ca	1860
caaaaggc	gg	tgaatgag	ct	gtttactt	ct	tccaatcaaa	tccgggttaa	aacagatgtg		1920
acggattat	c	atattgat	ca	agtatcca	at	ttagttgag	t	gtttatcaga	tgaattttgt	1980
ctggatgaa		aacaaga	att	gtccgagaa		gtcaa	acatg	cgaagcgact	tagtgatgag	2040
cggaattt	ac	ttcaagat	cc	aaacttc	aga	gggatcaata	gacaactaga	ccgtggctgg		2100
agaggaag	ta	cggatatt	ac	catccaag	ga	ggcgatgacg	tattcaaaga	gaattacgtt		2160
acgctatt	gg	gtaccttt	ga	tgagtgt	ctat	ccaacgtatt	tatatcaaaa	aatagatgag		2220
tcgaaatta		aagcctata	c	ccgttat	caa	ttaagagggt	atatcgaaga	tagtcaagac		2280
ttagaaat	ct	atttaatt	c	ctacaat	gca	aaacatgaaa	cagtaaatgt	gccaggtacg		2340
ggttcctt	at	ggccgctt	tc	agcccaa	agt	ccaatcgga	agtgtggaga	gccgaatcga		2400
tgcgcgcc	ac	accttga	atg	gaatcct	gac	ttagattgtt	cgtgtaggga	tggagaaaag		2460
tgtgcccat	c	attcgcat	ca	tttctc	ctta	gacattgatg	taggatgtac	agacttaaat		2520
gaggaccta	g	gtgtatgg	gt	gatcttta	ag	attaagacgc	aagatgggca	cgcaagacta		2580
gggaatcta	g	agtttct	cga	agagaaa	acca	ttagtaggag	aagcgctagc	tcgtgtgaaa		2640
agagcggag	a	aaaaatg	gag	agacaaa	cgt	gaaaaattgg	aatgggaaac	aaatatcgtt		2700
tataaagag	g	caaaaga	atc	tgtagat	gct	ttatttgtaa	actctcaata	tgatcaatta		2760
caagcggat	a	cgaatatt	gc	catgatt	cat	gcggcagata	aacgtgttca	tagcattcga		2820
gaagcttat	c	tgcc	t	gagct		gtctgtgatt	ccgggtgtca	atgcggctat	ttttgaagaa	2880
ttagaaggg	c	gtatttt	tcac	tgcat	tctcc	ctatatgatg	cgagaaatgt	cattaaaaat		2940
ggtgatttt	a	ataatgg	cctt	atcctg	ctgg	aacgtgaaag	ggcatgtaga	tgtagaagaa		3000
caaaaca	acc	aacgttc	gggt	ccttgtt	cctt	ccggaatggg	aagcagaagt	gtcacaagaa		3060
gttcgtgt	ct	gtccgggt	c	tggtat	atc	cttcgtgtca	cagcgtacaa	ggagggatat		3120
ggagaagg	tt	gcgtaacc	at	tcatgag	atc	gagaacaata	cagacgaact	ggagttagc		3180
aactgcg	tag	aagaggaa	at	ctatcca	aat	aacacggtaa	cgtgtaatga	ttatactgta		3240
aatcaaga	ag	aatacgg	agg	tgcgta	act	tctcgtaatc	gaggatataa	cgaagctcct		3300
tccgtacc	ag	ctgattat	gc	gtcagt	ctat	gaagaaaaat	cgtatacaga	tggacgaaga		3360
gagaatc	cctt	gtgaattt	aa	cagagggt	at	agggattaca	cgccactacc	agttgggtat		3420

gtgacaaaag aattagaata cttcccagaa accgataagg tatggattga gattggagaa 3480

acggaaggaa catttatcgt ggacagcgtg gaattactcc ttatggagga a 3531

<210> 2

<211> 1177

<212> PRT

<213> Bacillus thuringiensis

<400> 2

Met Asp Asn Asn Pro Asn Ile Asn Glu Cys Ile Pro Tyr Asn Cys Leu  
1 5 10 15

Ser Asn Pro Glu Val Glu Val Leu Gly Gly Glu Arg Ile Glu Thr Gly  
20 25 30

Tyr Thr Pro Ile Asp Ile Ser Leu Ser Leu Thr Gln Phe Leu Leu Ser  
35 40 45

Glu Phe Val Pro Gly Ala Gly Phe Val Leu Gly Leu Val Asp Ile Ile  
50 55 60

Trp Gly Ile Phe Gly Pro Ser Gln Trp Asp Ala Phe Leu Val Gln Ile  
65 70 75 80

Glu Gln Leu Ile Asn Gln Arg Ile Glu Glu Phe Ala Arg Asn Gln Ala  
85 90 95

Ile Ser Arg Leu Glu Gly Leu Ser Asn Leu Tyr Gln Ile Tyr Ala Glu  
100 105 110

Ser Phe Arg Glu Trp Glu Ala Asp Pro Thr Asn Pro Ala Leu Arg Glu  
115 120 125

Glu Met Arg Ile Gln Phe Asn Asp Met Asn Ser Ala Leu Thr Thr Ala  
130 135 140

Ile Pro Leu Phe Ala Val Gln Asn Tyr Gln Val Pro Leu Leu Ser Val  
145 150 155 160

Tyr Val Gln Ala Ala Asn Leu His Leu Ser Val Leu Arg Asp Val Ser  
165 170 175

Val Phe Gly Gln Arg Trp Gly Phe Asp Ala Ala Thr Ile Asn Ser Arg  
180 185 190

Tyr Asn Asp Leu Thr Arg Leu Ile Gly Asn Tyr Thr Asp Tyr Ala Val  
195 200 205

Arg Trp Tyr Asn Thr Gly Leu Glu Arg Val Trp Gly Pro Asp Ser Arg  
210 215 220

Asp Trp Val Arg Tyr Asn Gln Phe Arg Arg Glu Leu Thr Leu Thr Val  
225 230 235 240

Leu Asp Ile Val Ala Leu Phe Pro Asn Tyr Asp Ser Arg Arg Tyr Pro  
 245 250 255  
 Ile Arg Thr Val Ser Gln Leu Thr Arg Glu Ile Tyr Thr Asn Pro Val  
 260 265 270  
 Leu Glu Asn Phe Asp Gly Ser Phe Arg Gly Ser Ala Gln Gly Ile Glu  
 275 280 285  
 Arg Ser Ile Arg Ser Pro His Leu Met Asp Ile Leu Asn Ser Ile Thr  
 290 295 300  
 Ile Tyr Thr Asp Ala His Arg Gly Tyr Tyr Tyr Trp Ser Gly His Gln  
 305 310 315 320  
 Ile Met Ala Ser Pro Val Gly Phe Ser Gly Pro Glu Phe Thr Phe Pro  
 325 330 335  
 Leu Tyr Gly Thr Met Gly Asn Ala Ala Pro Gln Gln Arg Ile Val Ala  
 340 345 350  
 Gln Leu Gly Gln Gly Val Tyr Arg Thr Leu Ser Ser Thr Leu Tyr Arg  
 355 360 365  
 Arg Pro Phe Asn Ile Gly Ile Asn Asn Gln Gln Leu Ser Val Leu Asp  
 370 375 380  
 Gly Thr Glu Phe Ala Tyr Gly Thr Ser Ser Asn Leu Pro Ser Ala Val  
 385 390 395 400  
 Tyr Arg Lys Ser Gly Thr Val Asp Ser Leu Asp Glu Ile Pro Pro Gln  
 405 410 415  
 Asn Asn Asn Val Pro Pro Arg Gln Gly Phe Ser His Arg Leu Ser His  
 420 425 430  
 Val Ser Met Phe Arg Ser Gly Phe Ser Asn Ser Ser Val Ser Ile Ile  
 435 440 445  
 Arg Ala Pro Thr Phe Ser Trp Gln His Arg Ser Ala Glu Phe Asn Asn  
 450 455 460  
 Ile Ile Pro Ser Ser Gln Ile Thr Gln Ile Pro Leu Thr Lys Ser Thr  
 465 470 475 480  
 Asn Leu Gly Ser Gly Thr Ser Val Val Lys Gly Pro Gly Phe Thr Gly  
 485 490 495  
 Gly Asp Ile Leu Arg Arg Thr Ser Pro Gly Gln Ile Ser Thr Leu Arg  
 500 505 510  
 Val Asn Ile Thr Ala Pro Leu Ser Gln Arg Tyr Arg Val Arg Ile Arg  
 515 520 525  
 Tyr Ala Ser Thr Thr Asn Leu Gln Phe His Thr Ser Ile Asp Gly Arg  
 530 535 540

Pro Ile Asn Gln Gly Asn Phe Ser Ala Thr Met Ser Ser Gly Ser Asn  
 545 550 555 560  
 Leu Gln Ser Gly Ser Phe Arg Thr Val Gly Phe Thr Thr Pro Phe Asn  
 565 570 575  
 Phe Ser Asn Gly Ser Ser Val Phe Thr Leu Ser Ala His Val Phe Asn  
 580 585 590  
 Ser Gly Asn Glu Val Tyr Ile Asp Arg Ile Glu Phe Val Pro Ala Glu  
 595 600 605  
 Val Thr Phe Glu Ala Glu Tyr Asp Leu Glu Arg Ala Gln Lys Ala Val  
 610 615 620  
 Asn Glu Leu Phe Thr Ser Ser Asn Gln Ile Gly Leu Lys Thr Asp Val  
 625 630 635 640  
 Thr Asp Tyr His Ile Asp Gln Val Ser Asn Leu Val Glu Cys Leu Ser  
 645 650 655  
 Asp Glu Phe Cys Leu Asp Glu Lys Gln Glu Leu Ser Glu Lys Val Lys  
 660 665 670  
 His Ala Lys Arg Leu Ser Asp Glu Arg Asn Leu Leu Gln Asp Pro Asn  
 675 680 685  
 Phe Arg Gly Ile Asn Arg Gln Leu Asp Arg Gly Trp Arg Gly Ser Thr  
 690 695 700  
 Asp Ile Thr Ile Gln Gly Gly Asp Asp Val Phe Lys Glu Asn Tyr Val  
 705 710 715 720  
 Thr Leu Leu Gly Thr Phe Asp Glu Cys Tyr Pro Thr Tyr Leu Tyr Gln  
 725 730 735  
 Lys Ile Asp Glu Ser Lys Leu Lys Ala Tyr Thr Arg Tyr Gln Leu Arg  
 740 745 750  
 Gly Tyr Ile Glu Asp Ser Gln Asp Leu Glu Ile Tyr Leu Ile Arg Tyr  
 755 760 765  
 Asn Ala Lys His Glu Thr Val Asn Val Pro Gly Thr Gly Ser Leu Trp  
 770 775 780  
 Pro Leu Ser Ala Gln Ser Pro Ile Gly Lys Cys Gly Glu Pro Asn Arg  
 785 790 795 800  
 Cys Ala Pro His Leu Glu Trp Asn Pro Asp Leu Asp Cys Ser Cys Arg  
 805 810 815  
 Asp Gly Glu Lys Cys Ala His His Ser His His Phe Ser Leu Asp Ile  
 820 825 830  
 Asp Val Gly Cys Thr Asp Leu Asn Glu Asp Leu Gly Val Trp Val Ile  
 835 840 845

Phe Lys Ile Lys Thr Gln Asp Gly His Ala Arg Leu Gly Asn Leu Glu  
850 855 860

Phe Leu Glu Glu Lys Pro Leu Val Gly Glu Ala Leu Ala Arg Val Lys  
865 870 875 880

Arg Ala Glu Lys Lys Trp Arg Asp Lys Arg Glu Lys Leu Glu Trp Glu  
885 890 895

Thr Asn Ile Val Tyr Lys Glu Ala Lys Glu Ser Val Asp Ala Leu Phe  
900 905 910

Val Asn Ser Gln Tyr Asp Gln Leu Gln Ala Asp Thr Asn Ile Ala Met  
915 920 925

Ile His Ala Ala Asp Lys Arg Val His Ser Ile Arg Glu Ala Tyr Leu  
930 935 940

Pro Glu Leu Ser Val Ile Pro Gly Val Asn Ala Ala Ile Phe Glu Glu  
945 950 955 960

Leu Glu Gly Arg Ile Phe Thr Ala Phe Ser Leu Tyr Asp Ala Arg Asn  
965 970 975

Val Ile Lys Asn Gly Asp Phe Asn Asn Gly Leu Ser Cys Trp Asn Val  
980 985 990

Lys Gly His Val Asp Val Glu Glu Gln Asn Asn Gln Arg Ser Val Leu  
995 1000 1005

Val Leu Pro Glu Trp Glu Ala Glu Val Ser Gln Glu Val Arg Val  
1010 1015 1020

Cys Pro Gly Arg Gly Tyr Ile Leu Arg Val Thr Ala Tyr Lys Glu  
1025 1030 1035

Gly Tyr Gly Glu Gly Cys Val Thr Ile His Glu Ile Glu Asn Asn  
1040 1045 1050

Thr Asp Glu Leu Lys Phe Ser Asn Cys Val Glu Glu Glu Ile Tyr  
1055 1060 1065

Pro Asn Asn Thr Val Thr Cys Asn Asp Tyr Thr Val Asn Gln Glu  
1070 1075 1080

Glu Tyr Gly Gly Ala Tyr Thr Ser Arg Asn Arg Gly Tyr Asn Glu  
1085 1090 1095

Ala Pro Ser Val Pro Ala Asp Tyr Ala Ser Val Tyr Glu Glu Lys  
1100 1105 1110

Ser Tyr Thr Asp Gly Arg Arg Glu Asn Pro Cys Glu Phe Asn Arg  
1115 1120 1125

Gly Tyr Arg Asp Tyr Thr Pro Leu Pro Val Gly Tyr Val Thr Lys  
1130 1135 1140

Glu Leu Glu Tyr Phe Pro Glu Thr Asp Lys Val Trp Ile Glu Ile  
 1145 1150 1155

Gly Glu Thr Glu Gly Thr Phe Ile Val Asp Ser Val Glu Leu Leu  
 1160 1165 1170

Leu Met Glu Glu  
 1175

<210> 3  
 <211> 3537  
 <212> DNA  
 <213> *Bacillus thuringiensis*

<400> 3  
 atggataaca atccgaacat caatgaatgc attccttata attgtttaag taaccctgaa 60  
 gtagaagtat taggtggaga aagaatagaa actgggtaca cccaatcga tatttccttg 120  
 tcgctaacgc aatttctttt gagtgaattt gttcccggtg ctggatttgt gtaggacta 180  
 gttgatataa tatggggaat ttttgggtccc tctcaatggg acgcatttcc tgtacaaatt 240  
 gaacagttaa ttaaccaaag aatagaagaa ttcgctagga accaagccat ttctagatta 300  
 gaaggactaa gcaatcttta tcaaatttac gcagaatctt ttagagagtg ggaagcagat 360  
 cctactaatc cagcattaag agaagagatg cgtattcaat tcaatgacat gaacagtgcc 420  
 cttacaaccg ctattcctct tttggcagtt caaaattatc aagttcctct tttatcagta 480  
 tatgttcaag ctgcaaattt acatttatca gttttgagag atgtttcagt gtttggacaa 540  
 aggtggggat ttgatgccgc gactatcaat agtcgttata atgatttaac taggcctatt 600  
 ggcaactata cagattatgc tgtgcgctgg tacaatacgg gattagagcg tgtatgggga 660  
 ccggattcta gagattgggt aagggtataat caatttagaa gagagctaac acttactgta 720  
 ttagatatcg ttgctctatt ctcaaattat gatagtcgaa ggtatccaat tcgaacagtt 780  
 tccaatttaa caagagaaat ttatacgaac ccagtattag aaaattttga tggtagtttt 840  
 cgtggaatgg ctgagagaat agaacagaat attaggcaac cacatcttat ggatattcctt 900  
 aatagtataa ccatttatac tgatgtgcat agaggcttta attattggtc agggcatcaa 960  
 ataacagctt ctctgtagg gttttcagga ccagaattcg cattcccttt atttgggaat 1020  
 gcggggaatg cagctccacc cgtacttgtc tcattaactg gtttggggat ttttagaaca 1080  
 ttatcttcac ctttatatag aagaattata cttgggtcag gcccaaataa tcaggaactg 1140  
 tttgtccttg atggaacgga gttttctttt gcctccctaa cgaccaactt gccttccact 1200  
 atatatagac aaaggggtac agtcgattca ctatagtaa taccgccaca ggataatagt 1260



gtaccacctc	gtgcgggatt	tagccatcga	ttgagtcatg	ttacaatgct	gagccaagca	1320
gctggagcag	tttacacctt	gagagctcaa	cgtcctatgt	tctcttggat	acatcgtagt	1380
gctgaattta	ataatataat	tgcatcggat	agtattactc	aaatccctgc	agtgaaggga	1440
aactttcttt	ttaatgggtc	tgtaatttca	ggaccaggat	ttactggtgg	ggacttagtt	1500
agattaaata	gtagtgga	taacattcag	aatagagggt	atattgaagt	tccaattcac	1560
ttcccatcga	catctaccag	atatcgagtt	cgtgtacggg	atgcttctgt	aacccccgatt	1620
cacctcaacg	ttaattgggg	taattcatcc	atTTTTTcca	atacagtacc	agctacagct	1680
acgtcattag	ataatctaca	atcaagtgat	tttggttatt	ttgaaagtgc	caatgctttt	1740
acatcttcat	taggtaatat	agtaggtggt	agaaatttta	gtgggactgc	aggagtgata	1800
atagacagat	ttgaatttat	tccagttact	gcaacactcg	aggctgaata	taatctggaa	1860
agagcgcaga	aggcggtgaa	tgcgctgttt	acgtctacaa	accaactagg	gctaaaaaca	1920
aatgtaacgg	attatcatat	tgatcaagtg	tccaatttag	ttacgtattt	atcggatgaa	1980
ttttgtctgg	atgaaaagcg	agaattgtcc	gagaaagtca	aacatgcgaa	gcgactcagt	2040
gatgaacgca	atttactcca	agattcaaat	ttcaaagaca	ttaataggca	accagaacgt	2100
gggtggggcg	gaagtacagg	gattaccatc	caaggagggg	atgacgtatt	taaagaaaat	2160
tacgtcacac	tatcaggtac	ctttgatgag	tgctatccaa	catatttgta	tcaaaaaatc	2220
gatgaatcaa	aattaaaagc	ctttaccctg	tatcaattaa	gagggtatat	cgaagatagt	2280
caagacttag	aaatctattt	aattcgctac	aatgcaaaac	atgaaacagt	aaatgtgcca	2340
ggtacgggtt	ccttatggcc	gctttcagcc	caaagtccaa	tcggaaagtg	tgagagagccg	2400
aatcgatgcg	cgccacacct	tgaatggaat	cctgacttag	attgttcgtg	tagggatgga	2460
gaaaagtgtg	cccatcattc	gcatcatttc	tccttagaca	ttgatgtagg	atgtacagac	2520
ttaaatagagg	acctaggtgt	atgggtgatc	tttaagatta	agacgcaaga	tgggcacgca	2580
agactagga	atctagagtt	tctcgaagag	aaaccattag	taggagaagc	gctagctcgt	2640
gtgaaaagag	cggagaaaaa	atggagagac	aaacgtgaaa	aattggaatg	ggaaacaaat	2700
atcgtttata	aagaggcaaa	agaatctgta	gatgctttat	ttgtaaactc	tcaatatgat	2760
caattacaag	cggatacgaa	tattgccatg	attcatgcgg	cagataaacg	tgttcatagc	2820
attcgagaag	cttatctgcc	tgagctgtct	gtgattccgg	gtgtcaatgc	ggctatTTTT	2880
gaagaattag	aagggcggtat	tttcaactga	ttctccctat	atgatgagag	aaatgtcatt	2940

```

aaaaatggtg attttaataa tggcttatcc tgctggaacg tgaaagggca tgtagatgta 3000
gaagaacaaa acaaccaacg ttcggtcctt gttgttccgg aatgggaagc agaagtgtca 3060
caagaagttc gtgtctgtcc gggtcgtggc tatatccttc gtgtcacagc gtacaaggag 3120
ggatatggag aaggttgctg aaccattcat gagatcgaga acaatacaga cgaactgaag 3180
tttagcaact gcgtagaaga ggaaatctat ccaaataaca cggtaacgtg taatgattat 3240
actgtaaadc aagaagaata cggaggtgcg tacacttctc gtaatcgagg atataacgaa 3300
gctccttcgg taccagctga ttatgcgtca gtctatgaag aaaaatcgta tacagatgga 3360
cgaagagaga atccttgtga atttaacaga gggatatagg attacacgcc actaccagtt 3420
ggttatgtga caaaagaatt agaatacttc ccagaaaccg ataaggtatg gattgagatt 3480
ggagaaacgg aaggaacatt tatcgtggac agcgtggaat tactccttat ggaggaa 3537

```

```

<210> 4
<211> 1179
<212> PRT
<213> Bacillus thuringiensis

```

```

<400> 4
Met Asp Asn Asn Pro Asn Ile Asn Glu Cys Ile Pro Tyr Asn Cys Leu
1 5 10 15
Ser Asn Pro Glu Val Glu Val Leu Gly Gly Glu Arg Ile Glu Thr Gly
20 25 30
Tyr Thr Pro Ile Asp Ile Ser Leu Ser Leu Thr Gln Phe Leu Leu Ser
35 40 45
Glu Phe Val Pro Gly Ala Gly Phe Val Leu Gly Leu Val Asp Ile Ile
50 55 60
Trp Gly Ile Phe Gly Pro Ser Gln Trp Asp Ala Phe Pro Val Gln Ile
65 70 75 80
Glu Gln Leu Ile Asn Gln Arg Ile Glu Glu Phe Ala Arg Asn Gln Ala
85 90 95
Ile Ser Arg Leu Glu Gly Leu Ser Asn Leu Tyr Gln Ile Tyr Ala Glu
100 105 110
Ser Phe Arg Glu Trp Glu Ala Asp Pro Thr Asn Pro Ala Leu Arg Glu
115 120 125
Glu Met Arg Ile Gln Phe Asn Asp Met Asn Ser Ala Leu Thr Thr Ala
130 135 140
Ile Pro Leu Leu Ala Val Gln Asn Tyr Gln Val Pro Leu Leu Ser Val
145 150 155 160

```

Tyr Val Gln Ala Ala Asn Leu His Leu Ser Val Leu Arg Asp Val Ser  
 165 170 175  
 Val Phe Gly Gln Arg Trp Gly Phe Asp Ala Ala Thr Ile Asn Ser Arg  
 180 185 190  
 Tyr Asn Asp Leu Thr Arg Leu Ile Gly Asn Tyr Thr Asp Tyr Ala Val  
 195 200 205  
 Arg Trp Tyr Asn Thr Gly Leu Glu Arg Val Trp Gly Pro Asp Ser Arg  
 210 215 220  
 Asp Trp Val Arg Tyr Asn Gln Phe Arg Arg Glu Leu Thr Leu Thr Val  
 225 230 235 240  
 Leu Asp Ile Val Ala Leu Phe Ser Asn Tyr Asp Ser Arg Arg Tyr Pro  
 245 250 255  
 Ile Arg Thr Val Ser Gln Leu Thr Arg Glu Ile Tyr Thr Asn Pro Val  
 260 265 270  
 Leu Glu Asn Phe Asp Gly Ser Phe Arg Gly Met Ala Gln Arg Ile Glu  
 275 280 285  
 Gln Asn Ile Arg Gln Pro His Leu Met Asp Ile Leu Asn Ser Ile Thr  
 290 295 300  
 Ile Tyr Thr Asp Val His Arg Gly Phe Asn Tyr Trp Ser Gly His Gln  
 305 310 315 320  
 Ile Thr Ala Ser Pro Val Gly Phe Ser Gly Pro Glu Phe Ala Phe Pro  
 325 330 335  
 Leu Phe Gly Asn Ala Gly Asn Ala Ala Pro Pro Val Leu Val Ser Leu  
 340 345 350  
 Thr Gly Leu Gly Ile Phe Arg Thr Leu Ser Ser Pro Leu Tyr Arg Arg  
 355 360 365  
 Ile Ile Leu Gly Ser Gly Pro Asn Asn Gln Glu Leu Phe Val Leu Asp  
 370 375 380  
 Gly Thr Glu Phe Ser Phe Ala Ser Leu Thr Thr Asn Leu Pro Ser Thr  
 385 390 395 400  
 Ile Tyr Arg Gln Arg Gly Thr Val Asp Ser Leu Asp Val Ile Pro Pro  
 405 410 415  
 Gln Asp Asn Ser Val Pro Pro Arg Ala Gly Phe Ser His Arg Leu Ser  
 420 425 430  
 His Val Thr Met Leu Ser Gln Ala Ala Gly Ala Val Tyr Thr Leu Arg  
 435 440 445  
 Ala Gln Arg Pro Met Phe Ser Trp Ile His Arg Ser Ala Glu Phe Asn  
 450 455 460

Asn Ile Ile Ala Ser Asp Ser Ile Thr Gln Ile Pro Ala Val Lys Gly  
 465 470 475 480  
 Asn Phe Leu Phe Asn Gly Ser Val Ile Ser Gly Pro Gly Phe Thr Gly  
 485 490 495  
 Gly Asp Leu Val Arg Leu Asn Ser Ser Gly Asn Asn Ile Gln Asn Arg  
 500 505 510  
 Gly Tyr Ile Glu Val Pro Ile His Phe Pro Ser Thr Ser Thr Arg Tyr  
 515 520 525  
 Arg Val Arg Val Arg Tyr Ala Ser Val Thr Pro Ile His Leu Asn Val  
 530 535 540  
 Asn Trp Gly Asn Ser Ser Ile Phe Ser Asn Thr Val Pro Ala Thr Ala  
 545 550 555 560  
 Thr Ser Leu Asp Asn Leu Gln Ser Ser Asp Phe Gly Tyr Phe Glu Ser  
 565 570 575  
 Ala Asn Ala Phe Thr Ser Ser Leu Gly Asn Ile Val Gly Val Arg Asn  
 580 585 590  
 Phe Ser Gly Thr Ala Gly Val Ile Ile Asp Arg Phe Glu Phe Ile Pro  
 595 600 605  
 Val Thr Ala Thr Leu Glu Ala Glu Tyr Asn Leu Glu Arg Ala Gln Lys  
 610 615 620  
 Ala Val Asn Ala Leu Phe Thr Ser Thr Asn Gln Leu Gly Leu Lys Thr  
 625 630 635 640  
 Asn Val Thr Asp Tyr His Ile Asp Gln Val Ser Asn Leu Val Thr Tyr  
 645 650 655  
 Leu Ser Asp Glu Phe Cys Leu Asp Glu Lys Arg Glu Leu Ser Glu Lys  
 660 665 670  
 Val Lys His Ala Lys Arg Leu Ser Asp Glu Arg Asn Leu Leu Gln Asp  
 675 680 685  
 Ser Asn Phe Lys Asp Ile Asn Arg Gln Pro Glu Arg Gly Trp Gly Gly  
 690 695 700  
 Ser Thr Gly Ile Thr Ile Gln Gly Gly Asp Asp Val Phe Lys Glu Asn  
 705 710 715 720  
 Tyr Val Thr Leu Ser Gly Thr Phe Asp Glu Cys Tyr Pro Thr Tyr Leu  
 725 730 735  
 Tyr Gln Lys Ile Asp Glu Ser Lys Leu Lys Ala Phe Thr Arg Tyr Gln  
 740 745 750  
 Leu Arg Gly Tyr Ile Glu Asp Ser Gln Asp Leu Glu Ile Tyr Leu Ile  
 755 760 765

Arg Tyr Asn Ala Lys His Glu Thr Val Asn Val Pro Gly Thr Gly Ser  
 770 775 780  
 Leu Trp Pro Leu Ser Ala Gln Ser Pro Ile Gly Lys Cys Gly Glu Pro  
 785 790 795 800  
 Asn Arg Cys Ala Pro His Leu Glu Trp Asn Pro Asp Leu Asp Cys Ser  
 805 810 815  
 Cys Arg Asp Gly Glu Lys Cys Ala His His Ser His His Phe Ser Leu  
 820 825 830  
 Asp Ile Asp Val Gly Cys Thr Asp Leu Asn Glu Asp Leu Gly Val Trp  
 835 840 845  
 Val Ile Phe Lys Ile Lys Thr Gln Asp Gly His Ala Arg Leu Gly Asn  
 850 855 860  
 Leu Glu Phe Leu Glu Glu Lys Pro Leu Val Gly Glu Ala Leu Ala Arg  
 865 870 875 880  
 Val Lys Arg Ala Glu Lys Lys Trp Arg Asp Lys Arg Glu Lys Leu Glu  
 885 890 895  
 Trp Glu Thr Asn Ile Val Tyr Lys Glu Ala Lys Glu Ser Val Asp Ala  
 900 905 910  
 Leu Phe Val Asn Ser Gln Tyr Asp Gln Leu Gln Ala Asp Thr Asn Ile  
 915 920 925  
 Ala Met Ile His Ala Ala Asp Lys Arg Val His Ser Ile Arg Glu Ala  
 930 935 940  
 Tyr Leu Pro Glu Leu Ser Val Ile Pro Gly Val Asn Ala Ala Ile Phe  
 945 950 955 960  
 Glu Glu Leu Glu Gly Arg Ile Phe Thr Ala Phe Ser Leu Tyr Asp Ala  
 965 970 975  
 Arg Asn Val Ile Lys Asn Gly Asp Phe Asn Asn Gly Leu Ser Cys Trp  
 980 985 990  
 Asn Val Lys Gly His Val Asp Val Glu Glu Gln Asn Asn Gln Arg Ser  
 995 1000 1005  
 Val Leu Val Val Pro Glu Trp Glu Ala Glu Val Ser Gln Glu Val  
 1010 1015 1020  
 Arg Val Cys Pro Gly Arg Gly Tyr Ile Leu Arg Val Thr Ala Tyr  
 1025 1030 1035  
 Lys Glu Gly Tyr Gly Glu Gly Cys Val Thr Ile His Glu Ile Glu  
 1040 1045 1050  
 Asn Asn Thr Asp Glu Leu Lys Phe Ser Asn Cys Val Glu Glu Glu  
 1055 1060 1065

Ile Tyr Pro Asn Asn Thr Val Thr Cys Asn Asp Tyr Thr Val Asn  
1070 1075 1080

Gln Glu Glu Tyr Gly Gly Ala Tyr Thr Ser Arg Asn Arg Gly Tyr  
1085 1090 1095

Asn Glu Ala Pro Ser Val Pro Ala Asp Tyr Ala Ser Val Tyr Glu  
1100 1105 1110

Glu Lys Ser Tyr Thr Asp Gly Arg Arg Glu Asn Pro Cys Glu Phe  
1115 1120 1125

Asn Arg Gly Tyr Arg Asp Tyr Thr Pro Leu Pro Val Gly Tyr Val  
1130 1135 1140

Thr Lys Glu Leu Glu Tyr Phe Pro Glu Thr Asp Lys Val Trp Ile  
1145 1150 1155

Glu Ile Gly Glu Thr Glu Gly Thr Phe Ile Val Asp Ser Val Glu  
1160 1165 1170

Leu Leu Leu Met Glu Glu  
1175

<210> 5  
<211> 3531  
<212> DNA  
<213> Bacillus thuringiensis

<400> 5  
atggataaca atccgaacat caatgaatgc attccttata attgtttaag taaccctgaa 60  
gtagaagtat taggtggaga aagaatagaa actggttaca cccaatcga tatttccttg 120  
tcgctaacgc aatttccttt gagtgaattt gttcccgtg ctggatttgt gttaggacta 180  
gttgatataa tatggggaat ttttggtccc tctcaatggg acgcatttct tgtacaaatt 240  
gaacagttaa ttaaccaaag aatagaagaa ttcgctagga accaagccat ttctagatta 300  
gaaggactaa gcaatcttta tcaaatttac gcagaatctt ttagagagtg ggaagcagat 360  
cctactaatc cagcattaag agaagagatg cgtattcaat tcaatgacat gaacagtgcc 420  
cttacaaccg ctattcctct ttttgcagtt caaaattatc aagttcctct tttatcagta 480  
tatgttcaag ctgcaaattt acatttatca gttttgagag atgtttcagt gtttgacaa 540  
agggtgggat ttgatgccgc gactatcaat agtcgttata atgatttaac taggcttatt 600  
ggcaactata cagattatgc tgtacgctgg tacaatacgg gattagaacg tgtatgggga 660  
ccggattcta gagattgggt aagggtataat caatttagaa gagaattaac actaactgta 720  
ttagatatcg ttgctctgtt cccgaattat gatagtagaa gatatccaat tcgaacagtt 780

tcccaattaa caagagaaat ttatacaaac ccagtattag aaaattttga tggtagtttt	840
cgaggctcgg ctccagggcat agaaagaagt attaggagtc cacatttgat ggatatactt	900
aacagtataa ccatctatac ggatgctcat aggggttatt attattggtc agggcatcaa	960
ataatggctt ctctgtagg gttttcgggg ccagaattca cttttccgct atatggaact	1020
atgggaaatg cagctccaca acaacgtatt gttgctcaac taggtcaggg cgtgtataga	1080
acattatcgt ccactttata tagaagacct tttaatatag ggataaataa tcaacaacta	1140
tctgttcttg acgggacaga atttgcttat ggaacctcct caaatttgcc atccgctgta	1200
tacagaaaaa gcggaacggt agattcgctg aatgaaatac cgccacagaa taacaacgtg	1260
ccacctaggc aagaatttag tcatcgatta agccatgttt caatgtttcg ttcaggcttt	1320
agtaatagta gtgtaagtat aataagagct ccaacgtttt cttggcagca tcgcagtgc	1380
gaatttaata atataattcc ttcatacaaa attacacaaa tacctttaac aaaatctact	1440
aatcttggct ctggaacttc tgtcgtaaaa ggaccaggat ttacaggagg agatattctt	1500
cgaagaactt cacctggcca gatttcaacc ttaagagtaa atattactgc accattatca	1560
caaagatata gggtaagaat tcgctacgct tctactacaa atttacaatt ccatacatca	1620
attgacggaa gacctattaa tcagggtaat ttttcagcaa ctatgagtag tgggagtaat	1680
ttacagtcgg gaagcttttag gactgtaggt tttactactc cgtttaactt ttcaaagga	1740
tcaagtgtat ttacgttaag tgctcatgtc ttcaattcag gcaatgaagt ttatatagat	1800
cgaattgaat ttgttccggc agaagtaacc tttgaggcag aatatgattt agaaagagca	1860
caaaaggcgg tgaatgagct gtttacttct tccaatcaaa tcgggttaaa aacagatgtg	1920
acggattatc atattgatca agtatccaat ttagttgagt gtttatcaga tgaattttgt	1980
ctggatgaaa aacaagaatt gtccgagaaa gtcaaacatg cgaagcgact tagtgatgag	2040
cggaatttac ttcaagatcc aaacttcaga gggatcaata gacaactaga ccgtggctgg	2100
agaggaagta cggatattac catccaagga ggcgatgacg tattcaaaga gaattacgtt	2160
acgctatttg gtacctttga tgagtgtat ccaacgtatt tatatcaaaa aatagatgag	2220
tcgaaattaa aagcctatac ccgttatcaa ttaagagggt atatcgaaga tagtcaagac	2280
ttagaaatct atttaattcg ctacaatgca aaacatgaaa cagtaaatgt gccaggtag	2340
ggttccctat ggccgctttc agcccaaagt ccaatcgga agtgtggaga gccgaatcga	2400
tgccgcgccac accttgaatg gaatcctgac ttagattggt cgtgtaggga tggagaaaag	2460
tgtgcccatc attcgcatca tttctcctta gacattgatg taggatgtac agacttaaat	2520

gaggacctag gtgtatgggt gatctttaag attaagacgc aagatgggca cgcaagacta 2580  
 gggaatctag agtttctcga agagaaacca ttagtaggag aagcgctagc tcgtgtgaaa 2640  
 agagcggaga aaaaatggag agacaaacgt gaaaaattgg aatgggaaac aaatatcggt 2700  
 tataaagagg caaaagaatc tgtagatgct ttatttgtaa actctcaata tgatcaatta 2760  
 caagcggata cgaatattgc catgattcat gcggcagata aacgtgttca tagcattcga 2820  
 gaagcttata tgctgagct gtctgtgatt ccgggtgtca atgcggctat ttttgaagaa 2880  
 ttagaagggc gtattttcac tgcattctcc ctatatgatg cgagaaatgt cattaaaaat 2940  
 ggtgatttta ataatggctt atcctgctgg aacgtgaaag ggcatgtaga tgtagaagaa 3000  
 caaaacaacc aacgttcggt ccttggttctt ccggaatggg aagcagaagt gtcacaagaa 3060  
 gttcgtgtct gtccgggtcg tggctatata cttcgtgtca cagcgtacaa ggagggatat 3120  
 ggagaagggt gcgtaaccat tcatgagatc gagaacaata cagacgaact ggagtttagc 3180  
 aactgcgtag aagaggaaat ctatccaaat aacacggtaa cgtgtaatga ttatactgta 3240  
 aatcaagaag aatacggagg tgcgtacact tctcgtaatc gaggatataa cgaagctcct 3300  
 tccgtaccag ctgattatgc gtcagtctat gaagaaaaat cgtatacaga tggacgaaga 3360  
 gagaatcctt gtgaatttaa cagaggggat agggattaca cgccactacc agttgggttat 3420  
 gtgacaaaag aattagaata cttcccagaa accgataagg tatggattga gattggagaa 3480  
 acggaaggaa catttatcgt ggacagcgtg gaattactcc ttatggagga a 3531

<210> 6

<211> 1177

<212> PRT

<213> *Bacillus thuringiensis*

<400> 6

Met Asp Asn Asn Pro Asn Ile Asn Glu Cys Ile Pro Tyr Asn Cys Leu  
1 5 10 15

Ser Asn Pro Glu Val Glu Val Leu Gly Gly Glu Arg Ile Glu Thr Gly  
20 25 30

Tyr Thr Pro Ile Asp Ile Ser Leu Ser Leu Thr Gln Phe Leu Leu Ser  
35 40 45

Glu Phe Val Pro Gly Ala Gly Phe Val Leu Gly Leu Val Asp Ile Ile  
50 55 60

Trp Gly Ile Phe Gly Pro Ser Gln Trp Asp Ala Phe Leu Val Gln Ile  
65 70 75 80



Glu	Gln	Leu	Ile	Asn	Gln	Arg	Ile	Glu	Glu	Phe	Ala	Arg	Asn	Gln	Ala	85	90	95
Ile	Ser	Arg	Leu	Glu	Gly	Leu	Ser	Asn	Leu	Tyr	Gln	Ile	Tyr	Ala	Glu	100	105	110
Ser	Phe	Arg	Glu	Trp	Glu	Ala	Asp	Pro	Thr	Asn	Pro	Ala	Leu	Arg	Glu	115	120	125
Glu	Met	Arg	Ile	Gln	Phe	Asn	Asp	Met	Asn	Ser	Ala	Leu	Thr	Thr	Ala	130	135	140
Ile	Pro	Leu	Phe	Ala	Val	Gln	Asn	Tyr	Gln	Val	Pro	Leu	Leu	Ser	Val	145	150	155
Tyr	Val	Gln	Ala	Ala	Asn	Leu	His	Leu	Ser	Val	Leu	Arg	Asp	Val	Ser	165	170	175
Val	Phe	Gly	Gln	Arg	Trp	Gly	Phe	Asp	Ala	Ala	Thr	Ile	Asn	Ser	Arg	180	185	190
Tyr	Asn	Asp	Leu	Thr	Arg	Leu	Ile	Gly	Asn	Tyr	Thr	Asp	Tyr	Ala	Val	195	200	205
Arg	Trp	Tyr	Asn	Thr	Gly	Leu	Glu	Arg	Val	Trp	Gly	Pro	Asp	Ser	Arg	210	215	220
Asp	Trp	Val	Arg	Tyr	Asn	Gln	Phe	Arg	Arg	Glu	Leu	Thr	Leu	Thr	Val	225	230	235
Leu	Asp	Ile	Val	Ala	Leu	Phe	Pro	Asn	Tyr	Asp	Ser	Arg	Arg	Tyr	Pro	245	250	255
Ile	Arg	Thr	Val	Ser	Gln	Leu	Thr	Arg	Glu	Ile	Tyr	Thr	Asn	Pro	Val	260	265	270
Leu	Glu	Asn	Phe	Asp	Gly	Ser	Phe	Arg	Gly	Ser	Ala	Gln	Gly	Ile	Glu	275	280	285
Arg	Ser	Ile	Arg	Ser	Pro	His	Leu	Met	Asp	Ile	Leu	Asn	Ser	Ile	Thr	290	295	300
Ile	Tyr	Thr	Asp	Ala	His	Arg	Gly	Tyr	Tyr	Tyr	Trp	Ser	Gly	His	Gln	305	310	315
Ile	Met	Ala	Ser	Pro	Val	Gly	Phe	Ser	Gly	Pro	Glu	Phe	Thr	Phe	Pro	325	330	335
Leu	Tyr	Gly	Thr	Met	Gly	Asn	Ala	Ala	Pro	Gln	Gln	Arg	Ile	Val	Ala	340	345	350
Gln	Leu	Gly	Gln	Gly	Val	Tyr	Arg	Thr	Leu	Ser	Ser	Thr	Leu	Tyr	Arg	355	360	365
Arg	Pro	Phe	Asn	Ile	Gly	Ile	Asn	Asn	Gln	Gln	Leu	Ser	Val	Leu	Asp	370	375	380

Gly Thr Glu Phe Ala Tyr Gly Thr Ser Ser Asn Leu Pro Ser Ala Val  
 385 390 395 400  
 Tyr Arg Lys Ser Gly Thr Val Asp Ser Leu Asn Glu Ile Pro Pro Gln  
 405 410 415  
 Asn Asn Asn Val Pro Pro Arg Gln Glu Phe Ser His Arg Leu Ser His  
 420 425 430  
 Val Ser Met Phe Arg Ser Gly Phe Ser Asn Ser Ser Val Ser Ile Ile  
 435 440 445  
 Arg Ala Pro Thr Phe Ser Trp Gln His Arg Ser Ala Glu Phe Asn Asn  
 450 455 460  
 Ile Ile Pro Ser Ser Gln Ile Thr Gln Ile Pro Leu Thr Lys Ser Thr  
 465 470 475 480  
 Asn Leu Gly Ser Gly Thr Ser Val Val Lys Gly Pro Gly Phe Thr Gly  
 485 490 495  
 Gly Asp Ile Leu Arg Arg Thr Ser Pro Gly Gln Ile Ser Thr Leu Arg  
 500 505 510  
 Val Asn Ile Thr Ala Pro Leu Ser Gln Arg Tyr Arg Val Arg Ile Arg  
 515 520 525  
 Tyr Ala Ser Thr Thr Asn Leu Gln Phe His Thr Ser Ile Asp Gly Arg  
 530 535 540  
 Pro Ile Asn Gln Gly Asn Phe Ser Ala Thr Met Ser Ser Gly Ser Asn  
 545 550 555 560  
 Leu Gln Ser Gly Ser Phe Arg Thr Val Gly Phe Thr Thr Pro Phe Asn  
 565 570 575  
 Phe Ser Asn Gly Ser Ser Val Phe Thr Leu Ser Ala His Val Phe Asn  
 580 585 590  
 Ser Gly Asn Glu Val Tyr Ile Asp Arg Ile Glu Phe Val Pro Ala Glu  
 595 600 605  
 Val Thr Phe Glu Ala Glu Tyr Asp Leu Glu Arg Ala Gln Lys Ala Val  
 610 615 620  
 Asn Glu Leu Phe Thr Ser Ser Asn Gln Ile Gly Leu Lys Thr Asp Val  
 625 630 635 640  
 Thr Asp Tyr His Ile Asp Gln Val Ser Asn Leu Val Glu Cys Leu Ser  
 645 650 655  
 Asp Glu Phe Cys Leu Asp Glu Lys Gln Glu Leu Ser Glu Lys Val Lys  
 660 665 670  
 His Ala Lys Arg Leu Ser Asp Glu Arg Asn Leu Leu Gln Asp Pro Asn  
 675 680 685

Phe Arg Gly Ile Asn Arg Gln Leu Asp Arg Gly Trp Arg Gly Ser Thr  
 690 695 700  
 Asp Ile Thr Ile Gln Gly Gly Asp Asp Val Phe Lys Glu Asn Tyr Val  
 705 710 715 720  
 Thr Leu Leu Gly Thr Phe Asp Glu Cys Tyr Pro Thr Tyr Leu Tyr Gln  
 725 730 735  
 Lys Ile Asp Glu Ser Lys Leu Lys Ala Tyr Thr Arg Tyr Gln Leu Arg  
 740 745 750  
 Gly Tyr Ile Glu Asp Ser Gln Asp Leu Glu Ile Tyr Leu Ile Arg Tyr  
 755 760 765  
 Asn Ala Lys His Glu Thr Val Asn Val Pro Gly Thr Gly Ser Leu Trp  
 770 775 780  
 Pro Leu Ser Ala Gln Ser Pro Ile Gly Lys Cys Gly Glu Pro Asn Arg  
 785 790 795 800  
 Cys Ala Pro His Leu Glu Trp Asn Pro Asp Leu Asp Cys Ser Cys Arg  
 805 810 815  
 Asp Gly Glu Lys Cys Ala His His Ser His His Phe Ser Leu Asp Ile  
 820 825 830  
 Asp Val Gly Cys Thr Asp Leu Asn Glu Asp Leu Gly Val Trp Val Ile  
 835 840 845  
 Phe Lys Ile Lys Thr Gln Asp Gly His Ala Arg Leu Gly Asn Leu Glu  
 850 855 860  
 Phe Leu Glu Glu Lys Pro Leu Val Gly Glu Ala Leu Ala Arg Val Lys  
 865 870 875 880  
 Arg Ala Glu Lys Lys Trp Arg Asp Lys Arg Glu Lys Leu Glu Trp Glu  
 885 890 895  
 Thr Asn Ile Val Tyr Lys Glu Ala Lys Glu Ser Val Asp Ala Leu Phe  
 900 905 910  
 Val Asn Ser Gln Tyr Asp Gln Leu Gln Ala Asp Thr Asn Ile Ala Met  
 915 920 925  
 Ile His Ala Ala Asp Lys Arg Val His Ser Ile Arg Glu Ala Tyr Leu  
 930 935 940  
 Pro Glu Leu Ser Val Ile Pro Gly Val Asn Ala Ala Ile Phe Glu Glu  
 945 950 955 960  
 Leu Glu Gly Arg Ile Phe Thr Ala Phe Ser Leu Tyr Asp Ala Arg Asn  
 965 970 975  
 Val Ile Lys Asn Gly Asp Phe Asn Asn Gly Leu Ser Cys Trp Asn Val  
 980 985 990

Lys Gly His Val Asp Val Glu Glu Gln Asn Asn Gln Arg Ser Val Leu  
 995 1000 1005

Val Leu Pro Glu Trp Glu Ala Glu Val Ser Gln Glu Val Arg Val  
 1010 1015 1020

Cys Pro Gly Arg Gly Tyr Ile Leu Arg Val Thr Ala Tyr Lys Glu  
 1025 1030 1035

Gly Tyr Gly Glu Gly Cys Val Thr Ile His Glu Ile Glu Asn Asn  
 1040 1045 1050

Thr Asp Glu Leu Lys Phe Ser Asn Cys Val Glu Glu Glu Ile Tyr  
 1055 1060 1065

Pro Asn Asn Thr Val Thr Cys Asn Asp Tyr Thr Val Asn Gln Glu  
 1070 1075 1080

Glu Tyr Gly Gly Ala Tyr Thr Ser Arg Asn Arg Gly Tyr Asn Glu  
 1085 1090 1095

Ala Pro Ser Val Pro Ala Asp Tyr Ala Ser Val Tyr Glu Glu Lys  
 1100 1105 1110

Ser Tyr Thr Asp Gly Arg Arg Glu Asn Pro Cys Glu Phe Asn Arg  
 1115 1120 1125

Gly Tyr Arg Asp Tyr Thr Pro Leu Pro Val Gly Tyr Val Thr Lys  
 1130 1135 1140

Glu Leu Glu Tyr Phe Pro Glu Thr Asp Lys Val Trp Ile Glu Ile  
 1145 1150 1155

Gly Glu Thr Glu Gly Thr Phe Ile Val Asp Ser Val Glu Leu Leu  
 1160 1165 1170

Leu Met Glu Glu  
 1175

<210> 7  
 <211> 3531  
 <212> DNA  
 <213> Bacillus thuringiensis

<400> 7  
 atggataaca atccgaacat caatgaatgc attccttata attgtttaag taaccctgaa 60  
 gtagaagtat taggtggaga aagaatagaa actggttaca cccaatcga tatttccttg 120  
 tcgctaacgc aatttctttt gagtgaattt gttcccgtg ctggatttgt gtaggacta 180  
 gttgatataa tatggggaat ttttgggtccc tctcaatggg acgcatttct tgtacaaatt 240  
 gaacagttaa ttaaccaaag aatagaagaa ttcgctagga accaagccat ttctagatta 300  
 gaaggactaa gcaatcttta tcaaatttac gcagaatctt ttagagagtg ggaagcagat 360

cctactaatc cagcattaag agaagagatg cgtattcaat tcaatgacat gaacagtgcc	420
cttacaaccg ctattcctct ttttgcagtt caaaattatc aagttcctct tttatcagta	480
tatgttcaag ctgcaaattt acatttatca gttttgagag atgtttcagt gtttggacaa	540
aggtggggat ttgatgccgc gactatcaat agtcgttata atgatttaac taggcttatt	600
ggcaactata cagattatgc tgtacgctgg tacaatacgg gattagaacg tgtatgggga	660
ccggattcta gagattgggt aaggtataat caatttagaa gagaattaac actaactgta	720
ttagatatcg ttgctctgtt cccgaattat gatagtagaa gatatccaat tcgaacagtt	780
tccaattaa caagagaaat ttatacaaac ccagtattag aaaattttga tggtagtttt	840
cgaggctcgg ctcagggcat agaaggaagt attaggagtc cacatttgat ggatatactt	900
aacagtataa ccatctatac ggatgctcat aaaggggaat attattggtc agggcatcaa	960
ataatggctt ctctgtagg gttttcgggg ccagaattca cttttccgct atatggaact	1020
atgggaaatg cagctccaca acaacgtatt gttgctcaac taggtcaggg cgtgtataga	1080
acattatcgt ccactttata tagaagacct tttaatatag ggataaataa tcaacaacta	1140
tctgttcttg acgggacaga atttgcttat ggaacctcct caaatttgcc atccgctgta	1200
tacagaaaaa gcggaacggt agattcgctg gatgaaatac cgccacagaa taacaacgtg	1260
ccacctaggc aaggatttag tcatcgatta agccatgttt caatgtttcg ttcaggcttt	1320
agtaatagta gtgtaagtat aataagagct ccaacgtttt cttggcagca tcgcagtgct	1380
gaatttaata atataattcc ttcatacaaa attacacaaa tacctttaac aaaatctact	1440
aatcttggct ctggaacttc tgtcgttaaa ggaccaggat ttacaggagg agatattctt	1500
cgaagaactt cacctggcca gatttcaacc ttaagagtaa atattactgc accattatca	1560
caaagatatc gggtagaat tcgctacgct tctactacaa atttacaatt ccatacatca	1620
attgacggaa gacctattaa tcagggtaat ttttcagcaa ctatgagtag tgggagtaat	1680
ttacagtccg gaagcttttag gactgtaggt ttactactc cgtttaactt ttcaaattga	1740
tcaagtgtat ttacgttaag tgctcatgtc ttcaattcag gcaatgaagt ttatatagat	1800
cgaattgaat ttgttccggc agaagtaacc tttgaggcag aatatgattt agaaagagca	1860
caaaaggcgg tgaatgagct gtttacttct tccaatcaaa tcgggttaaa aacagatgtg	1920
acggattatc atattgatca agtatccaat ttagttgagt gtttatcaga tgaattttgt	1980
ctggatgaaa aacaagaatt gtccgagaaa gtcaaacatg cgaagcgact tagtgatgag	2040

cggaatttac ttcaagatcc aaacttcaga gggatcaata gacaactaga ccgtggctgg 2100  
 agaggaagta cggatattac catccaagga ggcatgacg tattcaaaga gaattacgtt 2160  
 acgctattgg gtacctttga tgagtgtat ccaacgtatt tatatcaaaa aatagatgag 2220  
 tcgaaattaa aagcctatac ccgttatcaa ttaagagggt atatcgaaga tagtcaagac 2280  
 ttagaaatct atttaattcg ctacaatgca aaacatgaaa cagtaaattgt gccaggtacg 2340  
 gggttccttat ggccgctttc agcccaaagt ccaatcgga agtgtggaga gccgaatcga 2400  
 tgcgcgccac accttgaatg gaatcctgac ttagattgtt cgtgtaggga tggagaaaaag 2460  
 tgtgcccac attcgcatca tttctcctta gacattgatg taggatgtac agacttaaatt 2520  
 gaggaacctag gtgtatgggt gatctttaag attaagacgc aagatgggca cgcaagacta 2580  
 gggaaatctag agtttctcga agagaaacca ttagtaggag aagcgctagc tcgtgtgaaa 2640  
 agagcggaga aaaaatggag agacaaacgt gaaaaattgg aatgggaaac aaatatcgtt 2700  
 tataaagagg caaaagaatc tgtagatgct ttatttgtaa actctcaata tgatcaatta 2760  
 caagcggata cgaatattgc catgattcat gcggcagata aacgtgttca tagcattcga 2820  
 gaagcttata tgctgagct gtctgtgatt ccgggtgtca atgcggctat ttttgaagaa 2880  
 ttagaagggc gtattttcac tgcattctcc ctatatgatg cgagaaattgt cattaataat 2940  
 ggtgatatta ataattggctt atcctgctgg aacgtgaaag ggcatgtaga tgtagaagaa 3000  
 caaaacaacc aacgttcggt ccttggttctt ccggaatggg aagcagaagt gtcacaagaa 3060  
 gttcgtgtct gtccgggtcg tggctatata cttcgtgtca cagcgtacaa ggagggatat 3120  
 ggagaagggt gcgtaaccat tcatgagatc gagaacaata cagacgaact ggagtttagc 3180  
 aactgcgtag aagaggaaat ctatccaaat aacacggtaa cgtgtaatga ttatactgta 3240  
 aatcaagaag aatacggagg tgcgtacact tctcgtaatc gaggatataa cgaagctcct 3300  
 tccgtaccag ctgattatgc gtcagtctat gaagaaaaat cgtatacaga tggacgaaga 3360  
 gagaatcctt gtgaatttaa cagagggtat agggattaca cgccactacc agttgggttat 3420  
 gtgacaaaag aattagaata cttcccagaa accgataagg tatggattga gattggagaa 3480  
 acggaaggaa catttatcgt ggacagcgtg gaattactcc ttatggagga a 3531

<210> 8

<211> 1177

<212> PRT

<213> *Bacillus thuringiensis*

<400> 8

Met Asp Asn Asn Pro Asn Ile Asn Glu Cys Ile Pro Tyr Asn Cys Leu  
 1 5 10 15  
 Ser Asn Pro Glu Val Glu Val Leu Gly Gly Glu Arg Ile Glu Thr Gly  
 20 25 30  
 Tyr Thr Pro Ile Asp Ile Ser Leu Ser Leu Thr Gln Phe Leu Leu Ser  
 35 40 45  
 Glu Phe Val Pro Gly Ala Gly Phe Val Leu Gly Leu Val Asp Ile Ile  
 50 55 60  
 Trp Gly Ile Phe Gly Pro Ser Gln Trp Asp Ala Phe Leu Val Gln Ile  
 65 70 75 80  
 Glu Gln Leu Ile Asn Gln Arg Ile Glu Glu Phe Ala Arg Asn Gln Ala  
 85 90 95  
 Ile Ser Arg Leu Glu Gly Leu Ser Asn Leu Tyr Gln Ile Tyr Ala Glu  
 100 105 110  
 Ser Phe Arg Glu Trp Glu Ala Asp Pro Thr Asn Pro Ala Leu Arg Glu  
 115 120 125  
 Glu Met Arg Ile Gln Phe Asn Asp Met Asn Ser Ala Leu Thr Thr Ala  
 130 135 140  
 Ile Pro Leu Phe Ala Val Gln Asn Tyr Gln Val Pro Leu Leu Ser Val  
 145 150 155 160  
 Tyr Val Gln Ala Ala Asn Leu His Leu Ser Val Leu Arg Asp Val Ser  
 165 170 175  
 Val Phe Gly Gln Arg Trp Gly Phe Asp Ala Ala Thr Ile Asn Ser Arg  
 180 185 190  
 Tyr Asn Asp Leu Thr Arg Leu Ile Gly Asn Tyr Thr Asp Tyr Ala Val  
 195 200 205  
 Arg Trp Tyr Asn Thr Gly Leu Glu Arg Val Trp Gly Pro Asp Ser Arg  
 210 215 220  
 Asp Trp Val Arg Tyr Asn Gln Phe Arg Arg Glu Leu Thr Leu Thr Val  
 225 230 235 240  
 Leu Asp Ile Val Ala Leu Phe Pro Asn Tyr Asp Ser Arg Arg Tyr Pro  
 245 250 255  
 Ile Arg Thr Val Ser Gln Leu Thr Arg Glu Ile Tyr Thr Asn Pro Val  
 260 265 270  
 Leu Glu Asn Phe Asp Gly Ser Phe Arg Gly Ser Ala Gln Gly Ile Glu  
 275 280 285  
 Gly Ser Ile Arg Ser Pro His Leu Met Asp Ile Leu Asn Ser Ile Thr  
 290 295 300

Ile Tyr Thr Asp Ala His Lys Gly Glu Tyr Tyr Trp Ser Gly His Gln  
 305 310 315 320  
 Ile Met Ala Ser Pro Val Gly Phe Ser Gly Pro Glu Phe Thr Phe Pro  
 325 330 335  
 Leu Tyr Gly Thr Met Gly Asn Ala Ala Pro Gln Gln Arg Ile Val Ala  
 340 345 350  
 Gln Leu Gly Gln Gly Val Tyr Arg Thr Leu Ser Ser Thr Leu Tyr Arg  
 355 360 365  
 Arg Pro Phe Asn Ile Gly Ile Asn Asn Gln Gln Leu Ser Val Leu Asp  
 370 375 380  
 Gly Thr Glu Phe Ala Tyr Gly Thr Ser Ser Asn Leu Pro Ser Ala Val  
 385 390 395 400  
 Tyr Arg Lys Ser Gly Thr Val Asp Ser Leu Asp Glu Ile Pro Pro Gln  
 405 410 415  
 Asn Asn Asn Val Pro Pro Arg Gln Gly Phe Ser His Arg Leu Ser His  
 420 425 430  
 Val Ser Met Phe Arg Ser Gly Phe Ser Asn Ser Ser Val Ser Ile Ile  
 435 440 445  
 Arg Ala Pro Thr Phe Ser Trp Gln His Arg Ser Ala Glu Phe Asn Asn  
 450 455 460  
 Ile Ile Pro Ser Ser Gln Ile Thr Gln Ile Pro Leu Thr Lys Ser Thr  
 465 470 475 480  
 Asn Leu Gly Ser Gly Thr Ser Val Val Lys Gly Pro Gly Phe Thr Gly  
 485 490 495  
 Gly Asp Ile Leu Arg Arg Thr Ser Pro Gly Gln Ile Ser Thr Leu Arg  
 500 505 510  
 Val Asn Ile Thr Ala Pro Leu Ser Gln Arg Tyr Arg Val Arg Ile Arg  
 515 520 525  
 Tyr Ala Ser Thr Thr Asn Leu Gln Phe His Thr Ser Ile Asp Gly Arg  
 530 535 540  
 Pro Ile Asn Gln Gly Asn Phe Ser Ala Thr Met Ser Ser Gly Ser Asn  
 545 550 555 560  
 Leu Gln Ser Gly Ser Phe Arg Thr Val Gly Phe Thr Thr Pro Phe Asn  
 565 570 575  
 Phe Ser Asn Gly Ser Ser Val Phe Thr Leu Ser Ala His Val Phe Asn  
 580 585 590  
 Ser Gly Asn Glu Val Tyr Ile Asp Arg Ile Glu Phe Val Pro Ala Glu  
 595 600 605



Val Thr Phe Glu Ala Glu Tyr Asp Leu Glu Arg Ala Gln Lys Ala Val  
 610 615 620  
 Asn Glu Leu Phe Thr Ser Ser Asn Gln Ile Gly Leu Lys Thr Asp Val  
 625 630 635 640  
 Thr Asp Tyr His Ile Asp Gln Val Ser Asn Leu Val Glu Cys Leu Ser  
 645 650 655  
 Asp Glu Phe Cys Leu Asp Glu Lys Gln Glu Leu Ser Glu Lys Val Lys  
 660 665 670  
 His Ala Lys Arg Leu Ser Asp Glu Arg Asn Leu Leu Gln Asp Pro Asn  
 675 680 685  
 Phe Arg Gly Ile Asn Arg Gln Leu Asp Arg Gly Trp Arg Gly Ser Thr  
 690 695 700  
 Asp Ile Thr Ile Gln Gly Gly Asp Asp Val Phe Lys Glu Asn Tyr Val  
 705 710 715 720  
 Thr Leu Leu Gly Thr Phe Asp Glu Cys Tyr Pro Thr Tyr Leu Tyr Gln  
 725 730 735  
 Lys Ile Asp Glu Ser Lys Leu Lys Ala Tyr Thr Arg Tyr Gln Leu Arg  
 740 745 750  
 Gly Tyr Ile Glu Asp Ser Gln Asp Leu Glu Ile Tyr Leu Ile Arg Tyr  
 755 760 765  
 Asn Ala Lys His Glu Thr Val Asn Val Pro Gly Thr Gly Ser Leu Trp  
 770 775 780  
 Pro Leu Ser Ala Gln Ser Pro Ile Gly Lys Cys Gly Glu Pro Asn Arg  
 785 790 795 800  
 Cys Ala Pro His Leu Glu Trp Asn Pro Asp Leu Asp Cys Ser Cys Arg  
 805 810 815  
 Asp Gly Glu Lys Cys Ala His His Ser His His Phe Ser Leu Asp Ile  
 820 825 830  
 Asp Val Gly Cys Thr Asp Leu Asn Glu Asp Leu Gly Val Trp Val Ile  
 835 840 845  
 Phe Lys Ile Lys Thr Gln Asp Gly His Ala Arg Leu Gly Asn Leu Glu  
 850 855 860  
 Phe Leu Glu Glu Lys Pro Leu Val Gly Glu Ala Leu Ala Arg Val Lys  
 865 870 875 880  
 Arg Ala Glu Lys Lys Trp Arg Asp Lys Arg Glu Lys Leu Glu Trp Glu  
 885 890 895  
 Thr Asn Ile Val Tyr Lys Glu Ala Lys Glu Ser Val Asp Ala Leu Phe  
 900 905 910

Val Asn Ser Gln Tyr Asp Gln Leu Gln Ala Asp Thr Asn Ile Ala Met  
 915 920 925  
 Ile His Ala Ala Asp Lys Arg Val His Ser Ile Arg Glu Ala Tyr Leu  
 930 935 940  
 Pro Glu Leu Ser Val Ile Pro Gly Val Asn Ala Ala Ile Phe Glu Glu  
 945 950 955 960  
 Leu Glu Gly Arg Ile Phe Thr Ala Phe Ser Leu Tyr Asp Ala Arg Asn  
 965 970 975  
 Val Ile Lys Asn Gly Asp Phe Asn Asn Gly Leu Ser Cys Trp Asn Val  
 980 985 990  
 Lys Gly His Val Asp Val Glu Glu Gln Asn Asn Gln Arg Ser Val Leu  
 995 1000 1005  
 Val Leu Pro Glu Trp Glu Ala Glu Val Ser Gln Glu Val Arg Val  
 1010 1015 1020  
 Cys Pro Gly Arg Gly Tyr Ile Leu Arg Val Thr Ala Tyr Lys Glu  
 1025 1030 1035  
 Gly Tyr Gly Glu Gly Cys Val Thr Ile His Glu Ile Glu Asn Asn  
 1040 1045 1050  
 Thr Asp Glu Leu Lys Phe Ser Asn Cys Val Glu Glu Glu Ile Tyr  
 1055 1060 1065  
 Pro Asn Asn Thr Val Thr Cys Asn Asp Tyr Thr Val Asn Gln Glu  
 1070 1075 1080  
 Glu Tyr Gly Gly Ala Tyr Thr Ser Arg Asn Arg Gly Tyr Asn Glu  
 1085 1090 1095  
 Ala Pro Ser Val Pro Ala Asp Tyr Ala Ser Val Tyr Glu Glu Lys  
 1100 1105 1110  
 Ser Tyr Thr Asp Gly Arg Arg Glu Asn Pro Cys Glu Phe Asn Arg  
 1115 1120 1125  
 Gly Tyr Arg Asp Tyr Thr Pro Leu Pro Val Gly Tyr Val Thr Lys  
 1130 1135 1140  
 Glu Leu Glu Tyr Phe Pro Glu Thr Asp Lys Val Trp Ile Glu Ile  
 1145 1150 1155  
 Gly Glu Thr Glu Gly Thr Phe Ile Val Asp Ser Val Glu Leu Leu  
 1160 1165 1170  
 Leu Met Glu Glu  
 1175

<210> 9  
<211> 151  
<212> DNA  
<213> Artificial Sequence

<220>

<223> synthetic DNA fragment used to insert point mutations into  
pEW3 to create the plasmid pACB-1.

<400> 9

atacagaaaa agcggaacgg tagattcgct gaatgaaata ccgccacaga ataacaacgt	60
gcccccgagg caagaattta gtcatcgatt aagccatggt tcaatgttta gatctggctt	120
tagtaatagt agtgtaagta taataagagc t	151